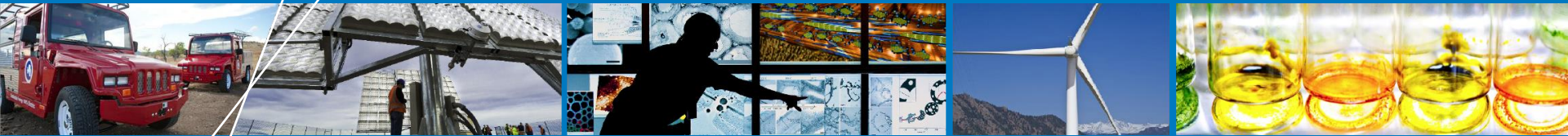


NREL Activities to Open Capital Market Investment and Bank Lending for Solar Deployment



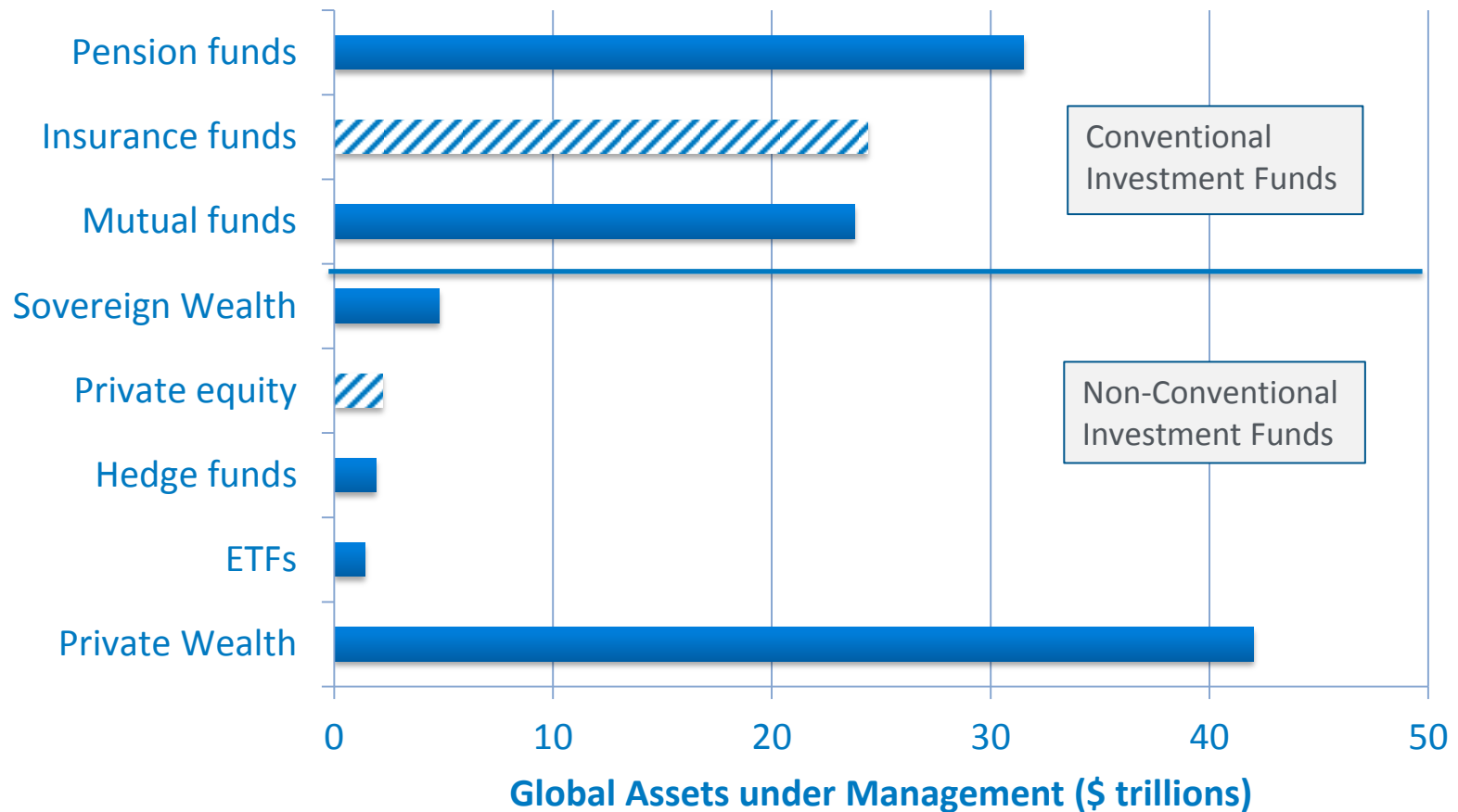
For NREL Finance Team Website

May 6, 2015

Value: Expand the Availability of Capital

Most managed funds do not invest in renewable energy.

To tap this capital, investors need a liquid, tradable product priced by the market



Hatched sources of capital currently invest in RE, but not necessarily from all investment buckets

Source: The CityUK

Capital Market Update

- YieldCos

- 11 on the market or announced^{1,2,3}
 - U.S. and Canada listings
- \$27 billion current combined market cap¹
- Yields in the 3 – 7% range²
- Notable:
 - NRG Yield – adding 65 MW of residential projects assets (\$150 mm)
 - 8point3 YieldCo combines First Solar (utility scale) and SunPower (resi) assets
 - NRG Yield up 85% since launch

- *NextEra Energy Partners*
- *NRG Yield*
- *Brookfield Renewable Energy Partner*
- *TransAlta Renewables*
- *Pattern Energy Group*
- *Abengoa Yield PLC*
- *Hannon Armstrong Sustainable Infrastructure*
- *TerraForm Power (SunEdison)*
- *8point3 (First Solar and SunPower)*
- *Canadian Solar*
- *Lightbeam Electric*

Source:

1. Bloomberg, 2015
2. Urdanick, 2014; Forbes, 2015
3. Power Finance & Risk, April 27, 2015

Cap. Market Update, cont'd.

- **Green Bonds**¹
 - \$36.6 billion in 2014
 - 2015 YTD \$7.8 billion (slower start)
 - Includes lots of different asset classes:
 - Transport
 - Renewables
 - “Social” projects
 - Very low yields - 0.125% to 8%
 - Development banks in Europe most active
 - European Investment Bank
 - KfW (Germany)
 - Bilateral Development Bank of Netherlands

Source: Climate
Bonds Initiative,
2015

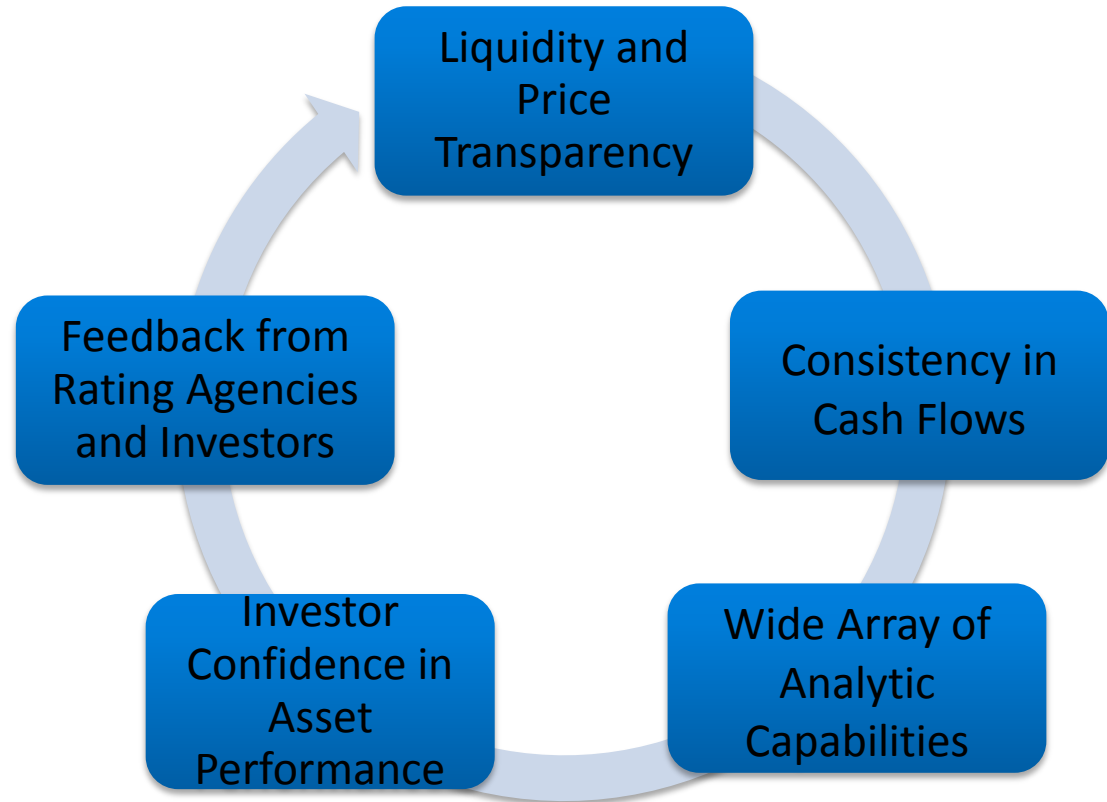
SolarCity Securitizations

	November 2013	April 2014	July 2014	Improvement?
Name	2013-1	2014-1	2014-2	
Yield	4.80%	4.59%	4.32%	Yes
Bond Size (\$ mm)	\$54.4	\$70.2	\$201.5	Yes
ADSAB (PV of cashflows - \$ mm)	\$87.8	\$106.2	\$276.0	Yes
Advance Rate (% of ADSAB)	62%	66%	73%	Yes
Wtd. Avg. Seasoning	22 months	12 months	7 months	Yes
Portfolio from Residential	71%	87%	86%	Yes
Rating	BBB+	BBB+	BBB+/BB	Neutral
Tranches	Single	Single	Sr/Sub	Yes

While an exciting development, the SolarCity securitizations only represent \$325 million funding relative to total industry annual investment of approximately \$14 billion

Broad Capital Market Participation Requires...

- i. **Asset and contractual consistency**, which allows project cash flows to be pooled into tradable and highly liquid securities, and
- ii. **Availability of data & tools to conduct due diligence** necessary to build market confidence in the asset class.



Characteristics of a highly functional investment ecosystem

Which creates virtuous cycle of...

NREL Securitization Activities: Project History

NREL Goal

Expand availability
of capital

Lower cost
of capital

Reduce
transaction cost,
time to
access capital

3 Yr. DOE Award:

Advanced Financing to Achieve SunShot

Facilitate financial innovation
thru asset consistency:

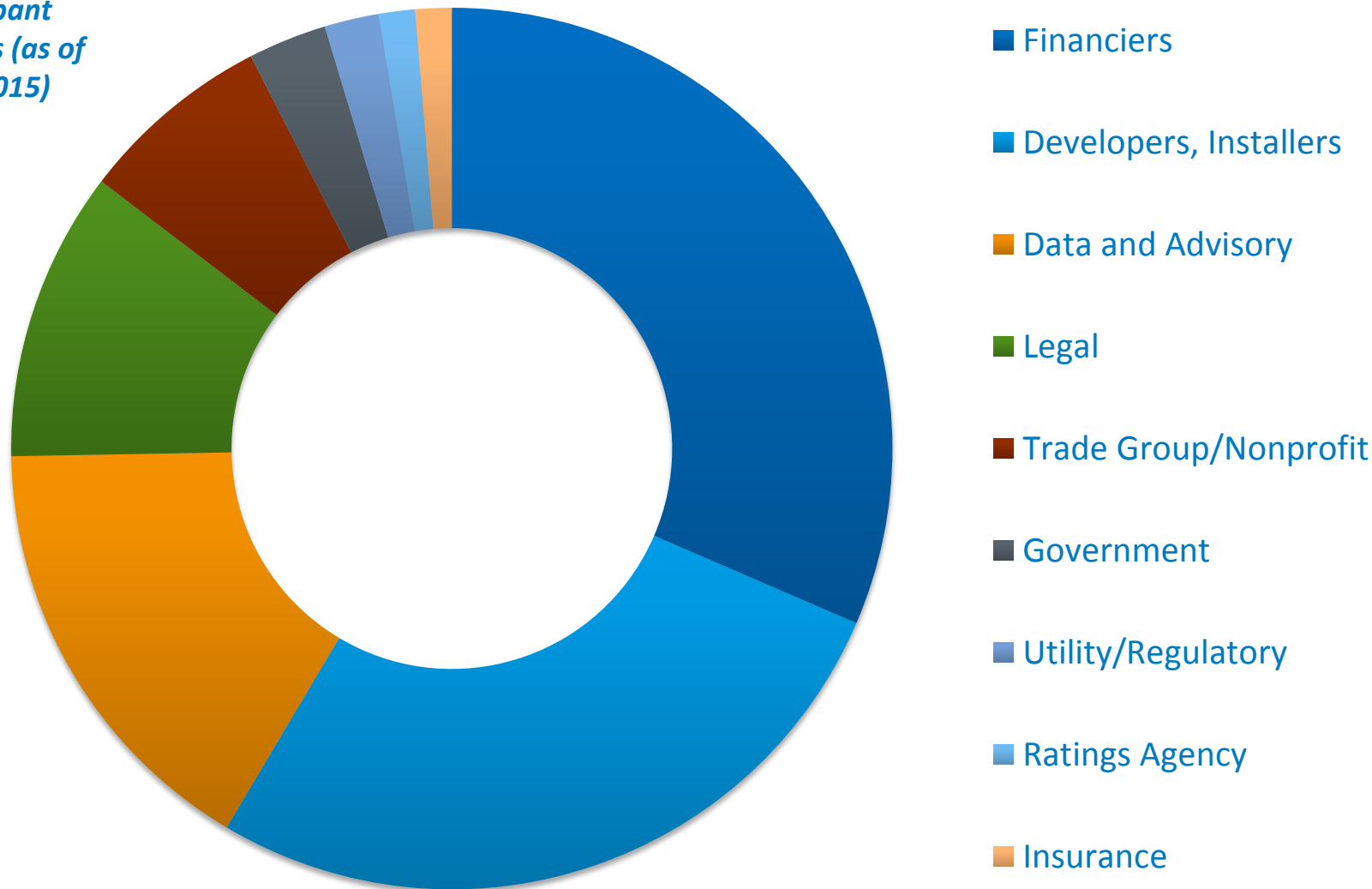
- Standard documents
- Best Practices
- Robust datasets

Conduct analysis to comprehend
opportunities and barriers

Promote adoption by developers,
financiers, law firms, etc.

Solar Access to Public Capital (SAPC)

*Over 450
Participant
Entities (as of
April 2015)*



SAPC Activities (All available at financeRE.nrel.gov)

- **Standard Contracts – 6 available and in wide use:**
 - Residential Lease, Power Purchase Agreement (PPA)
 - Commercial Lease, PPA
 - Currently working on loan product
- **Best Practices**
 - System Installation, Operation & Maintenance *released last month*
 - System Installation for C&I systems ongoing
- **Robust Datasets**
 - System performance: oSPARC (Open Solar Performance and Reliability Clearinghouse) [available here](#)
 - Largest public performance database
 - Credit performance too challenging
- **Mock Filing to Rating Agencies**
 - Residential mock presented to 5 rating agencies
 - Commercial mock w/ innovative tandem TE/debt structure

Standard Contracts

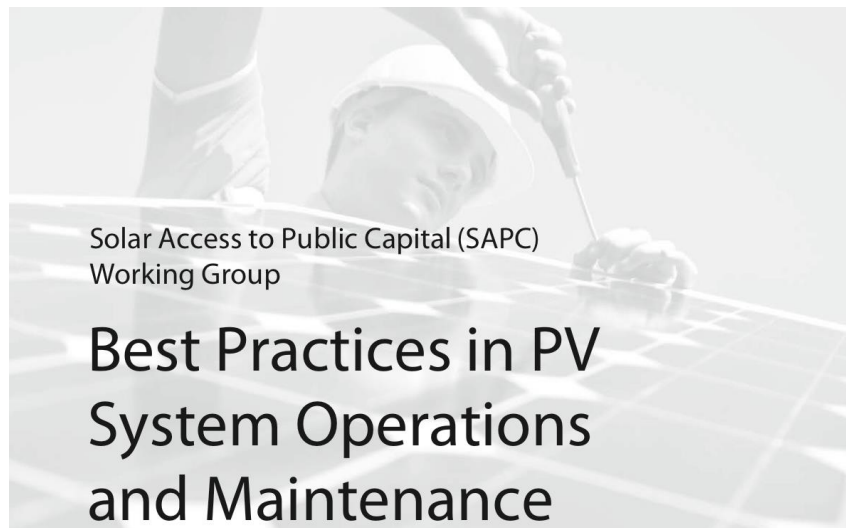
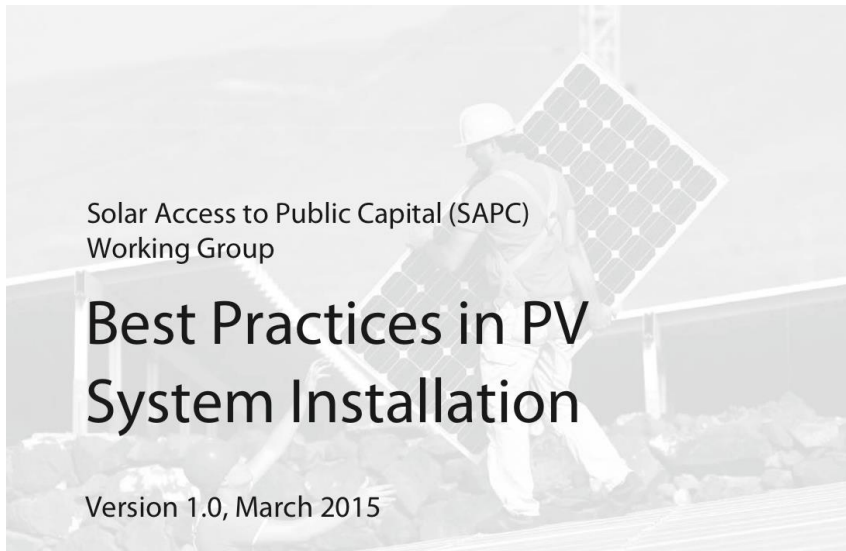
Adopters:

- Developers
 - SolarCity
 - Clean Power Finance
 - Sunrun
 - One Roof Energy
 - OnSwitch
 - Altus Power
 - Duke / REC Solar
- Law Firms
 - K&L Gates
 - Nixon Peabody
- Financing / Risk Platforms
 - Mercatus
 - truSolar
 - ModSolar
- Program Administrators
 - New York Power Authority

Benefits of Adoption:

- Enable market liquidity of projects
- Facilitate pooled investment vehicles
- Lower transaction costs
- Speed deployment
- Improve customer protection

Best Practices



- Released March 31st
- Two years in development
- Developed under dedicated SAPC subcommittees:
 - *engineering firms,*
 - *rating agencies,*
 - *financiers,*
 - *asset managers,*
 - *other stakeholders*

Performance Data Set: oSPARC

Largest public database of U.S. PV system performance - [available here](#)

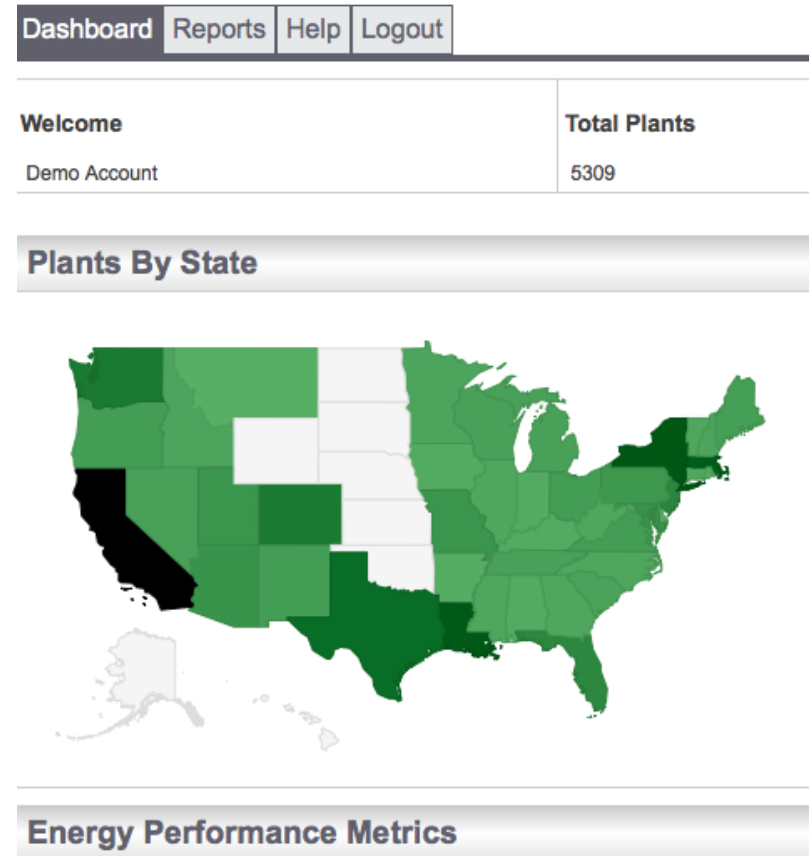
Second release – April 30th

- 3,800 systems across 42 states

Will be critical resource for:

- Early investors
- Asset owners
- Utilities & PUCs
- DOE, NREL, other labs, non-profits

“oSPARC Plus” initiative w/ GTM

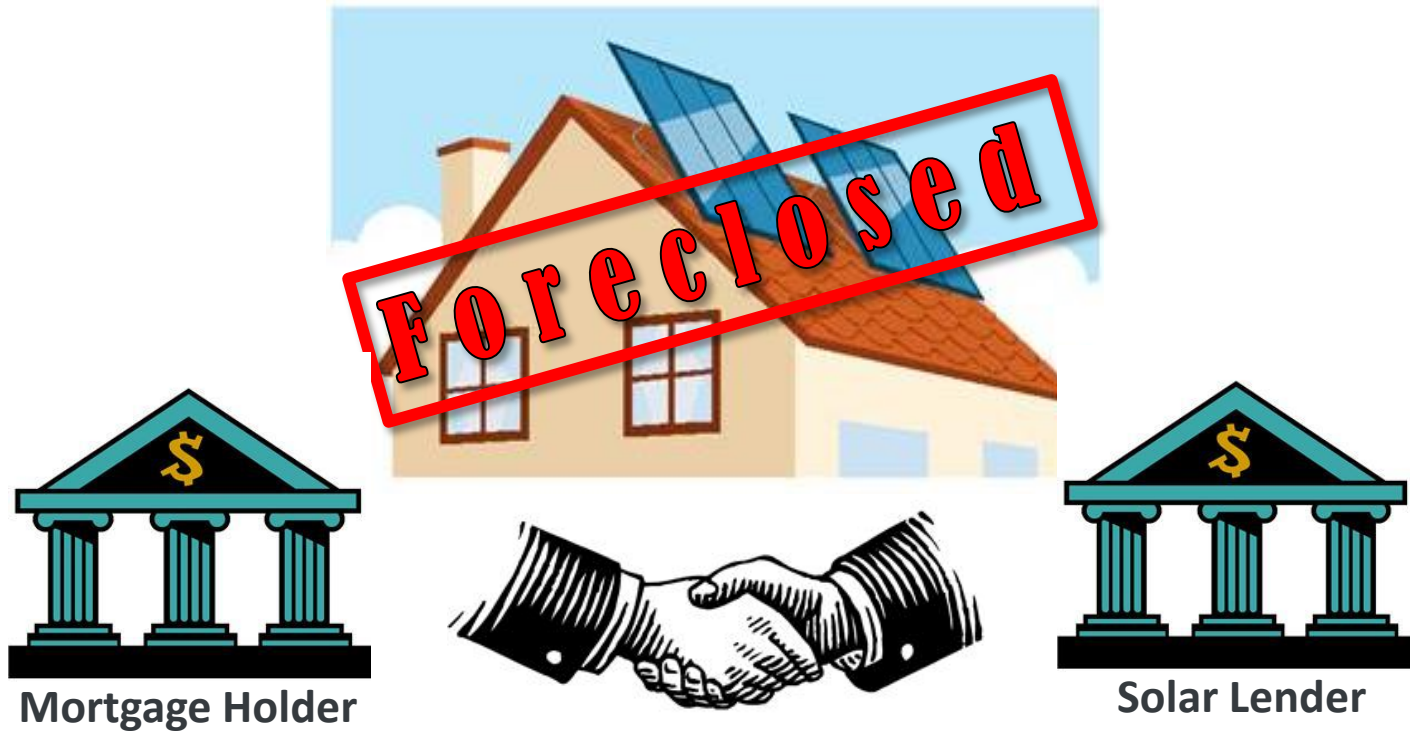


Banking on Solar – 2014 Task

- **Designed to facilitate direct lending for solar deployment**
 - Community banks
 - Credit Unions
 - Regional / National Banks
- **Working group: 100+ members**
 - Build consensus on underwriting principles
 - Develop educational materials for lenders & regulators (first piece for CEOs just completed)
 - Find solutions to complex legal / banking issues
 - Educate on PACE program benefits & opportunity
 - Promote to retail banking industry
- **Incorporated into broader SAPC effort**

Banking on Solar: Clarifying Legal Issues

What is the priority of liens between the mortgage holder and solar lender in the case of a homeowner default?



Banking on Solar is working with leading attorneys to draft template agreements and elucidate processes to ensure high levels of recovery for solar lenders

SAPC Mock Securitizations: Residential and Commercial

Benefits:

- *Legal term sheets* – lowering transaction costs for smaller entities to enter debt markets
- *Education* – of rating agencies & industry on risk perception, technology & credit performance
- *Structure* – tandem tax equity / debt structure could solve complex industry issue

1. Trustee and SPE Admin & Extraordinary Expense Reserve Top-off

2. Covered Expenses up to Monthly Cap

3. Master Servicer and Special Servicer Fee

4. O&M Provider Fee

5. Transaction Manager Fee

6. Class A Interest

7. Class B Interest

8. Reserve Account & Top-off

9. O&M Expense Res. Account & Top-off

10. Class A Expected Principal*

11.

12.

13.

14.

Priority of Payments – to protect investors

As mock “SolarCo” waterfall illustrates, securitizations are highly complex

International Expansion: China

Investment Ecosystem Elements 投资生态系统要素

As presented to China
PV and Finance
Investment Alliance,
April 3, 2015



*Funded by
DOE EERE
Int'l*

Next Steps for NREL Activities

- **Expand pool of potential investors**
 - *Insurance and specialty finance industries*
 - *Socially responsible investors (Ceres, others)*
 - *Real estate industry (REITs, etc.)*
- **Evolve and expand best practices, next suite of standard contracts, oSPARC data acquisition**
- **Develop report on mock securitization process**
- **Promote adoption of standard contracts, other assets**
 - *Developers*
 - *Investors*
 - *MUSH, non-profit markets*
 - *Large commercial end-users*
- **Engage banks & regulators on underwriting practices, data to comprehend asset class performance, etc.**
- **Others (e.g., open untapped markets, facilitate financial warehouses, etc.) proposed...**

Glossary

- **ABS – Asset-Backed Securities**
- **CDO – Collateralized Debt Obligations**
- **CLO – Collateralized Loan Obligations**
- **ETF – Exchange Traded Funds**
- **MBS – Mortgage-Backed Security**
- **MLP – Master Limited Partnership**
- **oSPARC – open Solar Performance and Reliability Clearinghouse**
- **REIT – Real Estate Investment Trust**
- **SEFA – Solar Energy Finance Association**